

Notice of Allowability

Application No.

10/068,214

Examiner

DIANE D. MIZRAHI

Applicant(s)

RAMESH ET AL.

Art Unit

2165

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 2-19-07.
2. ☒ The allowed claim(s) is/are 3-8, 10, 14, 16-23, 25, 28-32, 34, 36 and 37.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 5-10-07.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DIANE MIZRAHI
PRIMARY EXAMINER

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Attorney Harden E. Stevens, III on May 10, 2007.

Claims 3-8, 10, 14, 16-23, 25, 28-32, 34 and 36-37 are pending.

The amendment amends Applicant's original amendment dated 2-21-2007. The application has been amended as follows:

Claim 1 (Canceled):

Claim 2 (Canceled):

Claim 3 (currently amended) A method for use in a computer implemented relational database system to join spatial objects, the method comprising:

storing plural tables each containing spatial objects;

decomposing each of the spatial objects into z-cell subspaces according to z-ordering where each of the spatial objects is decomposed separately to a z-level specific to the characteristics of the spatial object;

distributing the subspaces across plural partitions; [[and]]

identifying at least one of the levels as an optimal join level at which a join of the spatial objects of plural tables occurs;

duplicating a given z-cell of a spatial object to the plural partitions if the z-level of the given z-cell is at least a predetermined number of z-levels above the optimal join level and enumerating the given z-cell if the z-level of the given z-cell is less than the predetermined number of levels above the optimal join level;

~~performing~~ executing, in parallel in the plural partitions, a join of the spatial objects of the plural tables[[]]; and

returning the results of the join of the spatial objects.

Claim 4 (original): The method of claim 3, wherein storing the plural tables containing spatial objects comprises storing the sets of z-cells, each set representing a spatial object.

Claim 5 (original): The method of claim 4, wherein storing the sets of z-cells comprises storing the sets at plural z-levels.

Claim 6 (Currently amended): The method of claim 5, further comprising identifying at least one of the plural z-levels as an optimal partition level at which partitioning of the spatial objects occurs.

Claim 7 (Original): The method of claim 6, wherein identifying the optimal partition level is based on a cost-based analysis.

Claim 8 (original): The method of claim 7, further comprising performing the cost-based analysis by accumulating a count of a number of z-cells at each level.

Claim 9 (Canceled): The method of claim 5, further comprising identifying at least one of the plural z-levels as an optimal join level at which a join of spatial objects of plural tables occurs.

Claim 10 (Currently amended): The method of claim [[9]]3, further comprising using a cost-based analysis to identify the optimal join level.

Claim 11 (Canceled): The method of claim 9, further comprising determining, based on the z-level a given z-cell of a spatial object is at, whether to duplicate the given z-cell or to enumerate the given z-cell into z-cells at a lower level.

Claim 12 (Canceled): The method of claim 11, further comprising duplicating the given z-cell to the plural partitions if the z-level of the given z-cell is at least a predetermined number of z-levels above the optimal join level and enumerating the given z-cell if the z-level of the given z-cell is less than the predetermined number of levels above the optimal join level.

Claim 13 (Canceled):

Claim 14 (Currently amended): The method of claim [[13]]3, wherein enumerating the given z-cell comprises dividing the given z-cell, if the z-level is greater than the optimal join level, the given z-cell into corresponding z-cells at the optimal join level, the method further comprising redistributing the z-cells at the optimal join level and if the z-level of the given z-cell is less than the optimal join level, the ancestor z-cell at the optimal join level containing the given z-cell, the method further comprising redistributing the z-cell at the optimal join level.

Claim 15 (Canceled):

Claim 16 (Currently amended): The method of claim [[15]]3, wherein performing the join of the spatial objects comprises performing joins of z-cells based on comparisons of intervals of z-cells at the optimal join level representing the spatial objects on each partition.

Claim 17 (original): The method of claim 16, further comprising performing false hit avoidance to avoid false hits due to comparisons performed at the optimal join level.

Claim 18 (original): The method of claim 16, further comprising performing duplicate avoidance.

Claim 19 (original): The method of claim 16, further comprising defining a z-cell less than the predetermined number of levels above the optimal join level, at the optimal join level, or below the optimal join level as having a zero-length interval,
the method further comprising optimizing the join for zero-length interval z-cells.

Claim 20 (original): The method of claim 16, further comprising defining a z-cell at least at the predetermined number of levels above the optimal join level as having a non-zero-length interval containing z-cells at the optimal join level.

Claim 21 (Previously amended): The method of claim 3, further comprising reducing skew in dividing the spatial objects across multiple partitions, and reducing duplication of objects to the multiple partitions to enhance efficient parallel spatial join.

Claim 22 (Previously amended): The method of claim 3, wherein dividing the spatial objects across plural partitions is based on characteristics of the spatial objects instead of characteristics of the tables.

Claim 23 (original): The method of claim 22, further comprising identifying an optimal partition level, wherein dividing the spatial objects comprises performing one of duplication, enumeration, and redistribution based on a relationship of a spatial object to the optimal partition level.

Claim 24 (canceled) :

Claim 25 (currently amended):

~~An article comprising at least one~~ A computer readable storage medium containing instructions that when executed by a computer cause a relational database system to:

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represent the spatial objects as z-cells in z-ordered space at plural z-levels;
define one of the z-levels as an optimal join level;
distribute the z-cells representing the spatial objects of tables across plural partitions;

[[and]]

identify whether a given z-cell is at least a predetermined number of z-levels above the optimal join level; and

duplicate the given z-cell to the plural partitions if the given z-cell is at least the predetermined number of z-levels above the optimal join level;

enumerate the given z-cell into z-cells at the optimal join level if the given z-cell is less than the predetermined number of z-levels above the optimal join level; and
distribute the z-cells at the optimal join level across the plural partitions; and

~~perform~~ execute a join of the distributed z-cells in each partition at the optimal join level;
and

return the results of the join.

Claim 26 (Canceled): The ~~article~~ storage medium of claim 25, wherein the instructions when executed cause the database system to further:

identify whether a given z-cell is at least a predetermined number of z-levels above the optimal join level; and

duplicate the given z-cell to the plural partitions if the given z-cell is at least the predetermined number of z-levels above the optimal join level;

enumerate the given z-cell into z-cells at the optimal join level if the given z-cell is less than the predetermined number of z-levels above the optimal join level; and

distribute the z-cells at the optimal join level across the plural partitions.

Claim 27 (Canceled):

Claim 28 (Currently amended): The ~~article~~ storage medium of claim ~~[[27]]~~25, wherein the enumerate step further comprises identifying an ancestor z-cell at the optimal join level containing the given z-cell. ~~instructions when executed cause the database system to further:~~

~~identify an ancestor z-cell at the optimal join level containing the given z-cell if the given z-cell is at a z-level less than the optimal join level.~~

Claim 29 (previously amended): The ~~article~~ storage medium of claim 25, wherein the instructions when executed cause the database system to further identify one of the z-levels as an optimal join level and one of the z-levels as an optimal partition level,

wherein performing the join is performed at the optimal join level, and

wherein distributing the z-cells representing the spatial objects is based on a relationship of each spatial object to the optimal partition level.

Claim 30 (Currently amended): The ~~article~~ storage medium of claim 29, wherein the instructions when executed cause the database system to identify the optimal join level and the optimal partition level based on a cost analysis.

Claim 31 (Currently amended): The ~~article~~ storage medium of claim 25, wherein the instructions when executed cause the database system to further perform false hit avoidance and duplicate avoidance.

Claim 32 (Currently amended): The ~~article~~ storage medium of claim 31, wherein the instructions when executed cause the database system to further:

define certain of the z-cells as having a zero-length interval; and

optimize the join for zero-length interval z-cells.

Claim 33 (canceled):

Claim 34 (currently amended):

A computer implemented relational database system used to join spatial object, the system comprising:

- a storage subsystem to store tables containing spatial objects;
- a plurality of access modules to manage parallel access of respective portions of the storage subsystem; and
- a controller for:
 - decomposing each of the spatial objects into z-cell subspaces according to z-ordering where each of the spatial objects is decomposed separately to a z-level specific to the characteristics of the spatial object; [[and]]
 - distributes z-cells of the spatial objects across the access modules by performing one of duplication, enumeration, and redistribution of each spatial object;
 - [[for]]managing initiating a parallel join of the spatial objects by the plurality of access modules; and
 - returning the results of the parallel join of the spatial objects.

Claim 35 (canceled):

Claim 36 (Previously amended): The database system of claim 34, wherein ~~the z-cells representing the spatial objects are in plural z-levels, the controller identifies one of the plural z-levels as an optimal join level, and~~
the controller performs the parallel join of the z-cells at the optimal join level.

Claim 37 (Previously amended): The database system of claim 36, wherein the controller:
identifies one of the z-levels as an optimal partition level; and
distributes each spatial object across the plural access modules according to a relationship of the spatial object to the optimal partition level.

Claim 38 (Canceled): The database system of claim 34, wherein the controller distributes z-cells of the spatial objects across the access modules.

Claim 39 (Canceled): The database system of claim 38, wherein the controller distributes the z-cells by performing one of duplication, enumeration, and redistribution of each spatial object.

Allowable Subject Matter

Claims 3-8, 10, 14, 16-23, 25, 28-32, 34 and 36-37 are allowed over the prior art made of record.

Applicant's computer implemented relational database system to join spatial objects which includes decomposing plural tables of the spatial objects into z-cell subspaces according to z-ordering where each of the spatial objects is decomposed separately to a z-level specific to the characteristics of the spatial object, distributing the subspaces across plural partitions, optimizing join level of the spatial objects of plural tables, duplicating a given z-cell of a spatial object to the plural partitions if the z-level of the given z-cell is at least a predetermined number of z-levels above the optimal join level and enumerating the given z-cell if the z-level of the given z-cell is less than the predetermined number of levels above the optimal join level, and executing, in parallel in the plural partitions a join of the spatial objects of the plural tables in combination with the other limitations of the claims, was not disclosed by, would not have been obvious over, nor would have been fairly suggested by the prior art of record.

The dependent claims, being further limiting to the independent claims, definite and enabled by the Specification are also allowed.

Comments

The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the

corresponding amount of the fee. In no case may an applicant reply outside the SIX (6) MONTH statutory period or obtain an extension for more than FIVE (5) MONTHS beyond the date for reply set forth in an Office action. A fully responsive reply must be timely filed to avoid abandonment of this application.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

As allowable subject matter has been indicated, Applicant's response must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP section 707.07(a).

Other Prior Art Made of Record

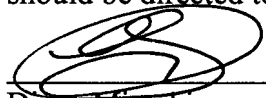
The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure. U.S. patents and U.S. patent application publications will not be supplied with Office actions. Examiners advises the Applicant that the cited U.S. patents and patent application publications are available for download via the Office's PAIR. As an alternate source, all U.S. patents and patent application publications are available on the USPTO web site (www.uspto.gov), from the Office of Public Records and from commercial sources. For the use of the Office's PAIR system, Applicants may refer to the Electronic Business Center (EBC) at <http://www.uspto.gov/ebc/index.html> or 1-866-217-9197.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Diane D. Mizrahi whose telephone number is 571-272-4079. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Gaffin can be reached on (571) 272-4146. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 305-3900 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.



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May 11, 2007